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MASTER OF MILITARY STUDIES

Marine Artillery for the Future
"One Size Doesn't Fit All"

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EXECUTIVE SUMMARY

Title: Marine Artillery for the future, "One size doesn't fit all."

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Thesis: The current Marine Corps artillery structure and organization is not sufficient to meet the needs of the Marine Corps of the future.

Discussion: Since 1988, the Marine Corps' artillery has been reduced by approximately 57%. This reduction in both size and capability is unacceptable, and in the words of our 32nd Commandant, "We have atrophied our Marine ground fires inventory to a dangerous point." Having realized this gross reduction in capability, the Commandant set out to fix the artillery. In July of 2000, the Chairman, Marine Corps Ground Board, established an Artillery Operational Advisory Group (OAG) to address issues relating to the Marine Corps fire support system and to determine a solution. The OAG is currently proposing a triad of systems that will address the future needs of the Marine Corps.

Conclusion: The OAG's proposed solution represents a good foundation to addressing the problems with Marine artillery, but as with most any problem, there is generally more than one solution. My proposed solution will allow a greater amount of capability and flexibility to be resident within the division, and should be sufficient to meet the needs of the future Marine Corps.

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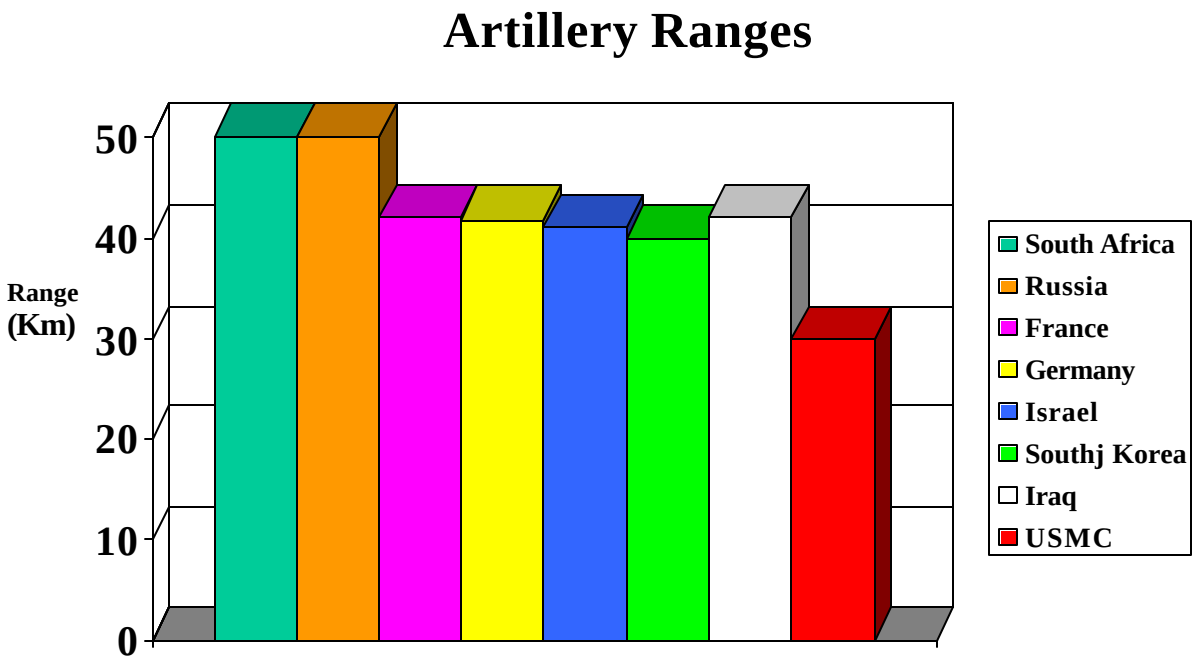

Introduction

During the 1980's the United States Marine Corps went from an artillery force consisting of 5 different artillery systems[1] capable of performing a multitude of roles and missions to a single system, the M198 155mm howitzer. Arguably, there were numerous factors involved in the degradation of the ground based fire support for the Marine Corps, but no matter what the factors, the argument still exists that maintaining only one artillery weapons system is not sufficient to meet the needs of the Marine Corps. The United States Marine Corps is the only major armed force in the world that has only one artillery system as its sole source of ground based fire support.[2] This fact alone should be compelling enough to cause one to question the wisdom of choosing to fight with a "one size fits all" mentality about artillery. Is the current Marine Corps artillery organization and force structure sufficient to meet the needs of the Marine Corps of the future? If one artillery system is inadequate to meet the needs of the Marine Corps of either the present or the future, then what is the answer to fixing Marine artillery? Does it even need to be fixed?

Numerous articles and papers have addressed the issue of fixing the Marine artillery in the past 20 years, and it has not escaped the purview of our current commandant, General James L. Jones. In an interview with the Field Artillery Journal, General Jones stated, "In the past 10 or so years, we have decreased our fire support systems too far. We got rid of a lot of our artillery weapons systems in the name of mobility and we hinged ourselves to one Field Artillery system—the M198 towed 155-mm howitzer."[3]

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[1] M198 155mm, M101A1 105mm, M110 8 in, 175mm, and M109 155mm
[2] Armada International 4/2001.
[3] Field Artillery Journal, Sept - Oct 2000, 3.

Yet as we enter the 21st Century, the problem still persists with little relief looming on the horizon. The solution to the problem lies in an analysis of the National Military Strategy, the Joint Vision 2020, the Marine Corps' operational concepts to support that vision, the roles and missions that the artillery must be able to accomplish, and the systems, techniques and force structure needed to successfully fight and win the nations battles.

Recent History of Marine Artillery

Since 1988, the Marine Corps' artillery has been reduced by approximately 57%.[4] How did a reduction of over half of the artillery in the Marine Corps occur? There are several reasons for the dramatic reduction, and each one ate away at pieces of the force. A large part of the reduction came when all of the services were downsized following the end of the cold war. The Marine Corps went from 194,000 active duty Marines to 174,000. Force structure cuts affected almost all of the force.

In 1988, Marine Artillery was moving to a structure that consisted of 5 Battalions in each division. Three of these were 155mm towed battalions and the other two were a mix of both 155mm and 8 inch self propelled systems, except in the 3rd Marine Division where four of the battalions were 155mm towed and the fourth was 8 inch self propelled. The self-propelled battalions were considered to be general support battalions and were structured for that particular tactical mission, while the towed battalions were primarily close support battalions that habitually provided direct support to a particular maneuver regiment. It must be stated that an artillery battalion that is structured for a direct support mission can in fact perform any of the four standard tactical missions normally assigned,

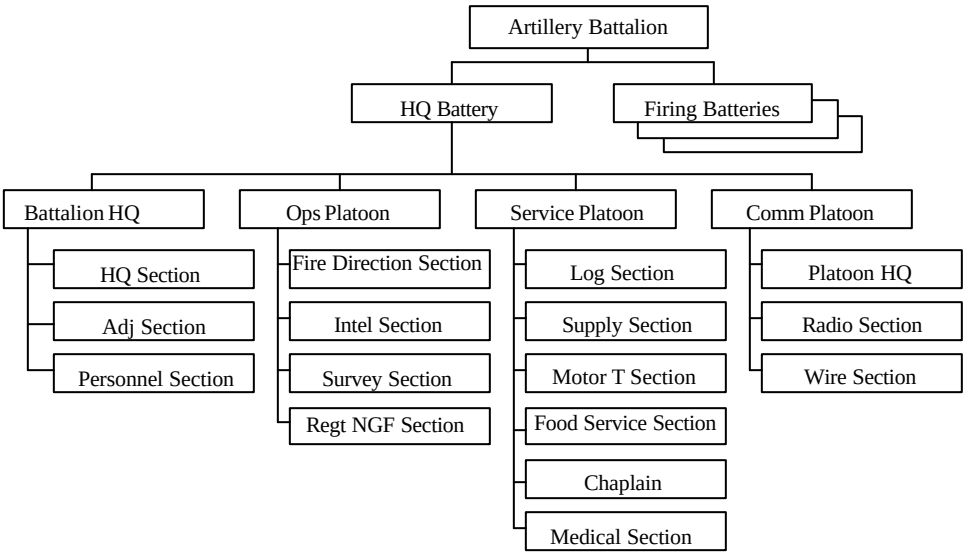
[4] Ibid.

while a general support battalion lacks some of the liaison personnel to accomplish a direct support mission. The three towed battalions each consisted of three batteries containing 8 howitzers, divided into two platoons of four guns each. Each platoon maintained a fire direction center (FDC) and had the capability to accomplish both technical and tactical fire direction. This "3X8" structure provided a great deal of flexibility to both the maneuver units and to the artillery battalion headquarters. One of the platoons could displace forward during a battle while the other remained fire capable, thus providing continuous fire support to the supported maneuver commander.

After Desert Storm, the configuration of the Regiment changed dramatically. The Fourth Battalion of each regiment was disbanded and the four remaining battalions all became structured to accomplish all standard tactical missions. All self-propelled howitzers were replaced with towed 155mm M198s. Thus, all of the artillery units in the Marines looked the same. At the same time, the battery structure of each battalion was changed from a 3X8 structure to a 4X6 structure, meaning that each battalion consisted of four batteries of six guns each. The change appeared to have little impact to most Marines outside of the artillery because the 3X8 battalion and the 4X6 battalion each contained 24 guns. What they did not see was that a great deal of flexibility was lost as well. In the 4X6 organization, each battery contained only one FDC, which controlled all six howitzers. Once a battery displaced, another battery was required to respond to whatever unit the displacing battery had been supporting, as well as their own.

In the early1990s, one of the four batteries in each battalion was disbanded to make structure room for a battery of MLRS (Multiple Launched Rocket System) in each artillery regiment. But the decision was made not to procure MLRS, and the lost

structure was never regained. The current Marine artillery regiment at the time of this paper contains four battalions of towed 155mm howitzers. Each battalion contains three batteries of six guns each. The organization is shown in Figure 1.



Current Organization of all Marine Artillery Battalions

Figure 1.

The Current Problem

In every other combat system in the Marine Corps there exists multiple and redundant systems with overlapping capabilities to meet a variety of tactical situations. As examples, the Marine Corps has more than one type of combat aircraft (both in the fixed wing and rotary wing communities), more than one type of machine gun, more than one type of mortar, and more than one type of armored vehicle. And yet only one artillery system exists to act as the primary artillery weapons system to the force. But does the Marine Corps really need more than one artillery system? How does one determine the appropriate structure for Marine artillery? I believe that the answer lies in determining what the future holds from a national perspective, specifying the roles that the artillery

will play in future scenarios, and then determine what capabilities will be required to meet those needs.

Roles and Missions of the Military

The President of the United States and the Secretary of Defense provide guidance for the armed forces in the form of a National Security Strategy, and that guidance is translated into a National Military Strategy, which states in part,

> Regional conflict remains possible, proliferation of weapons of mass destruction is a major concern, and we face a number of nontraditional, transnational, and unpredictable threats to our security…Some state or nonstate actors may resort to asymmetric means to counter the US military. Such means include unconventional or inexpensive approaches that circumvent our strengths, exploit our vulnerabilities, or confront us in ways we cannot match in kind…**We must increase our capabilities to counter these threats** and adapt our military doctrine, training, and equipment to ensure a rapid and effective joint and interagency response.[5]

It further goes on to state,

> As noted throughout this NMS, the US military must have capabilities that give the national leadership **a range of viable options** for promoting and protecting US interests in peacetime, crisis, and war. …must be able to defeat adversaries in **two distant, overlapping major theater wars** from a posture of global engagement and in the face of WMD and other asymmetric threats. It must **respond across the full spectrum of crises**, from major combat to humanitarian assistance operations. It must be ready to conduct and sustain **multiple, concurrent smaller-scale contingency operations**.[6]

The issue of engaging in two near simultaneous major theater wars (MTW) obviously poses a significant challenge to the nation. While it is generally understood that the United States will not enter into either MTW unilaterally, the assets of the armed forces will have to be skillfully crafted into an organization that ensures victory in both conflicts. This will require careful allocation of limited resources based on their ability to fight and win the first MTW while holding the enemy forces in the second MTW until resources can be freed from the first. Commanders at the strategic an operational levels will be required to use each asset available to them based on that assets capabilities and use each to optimize the amount of combat power available. Because of the rapid

[5] National Military Strategy of the United States, 9.
[6] Ibid.

mobility and re-deployability of combat aircraft, they will more than likely be shifted from one MTW to the other quickly, leaving the ground based systems in the first MTW to finish the battle prior to redeploying to the second MTW. In this scenario, the capabilities of ground based fire support assets will be critical to ensuring success in both MTWs. In addressing the future of the military, the National Security Strategy states,

> Transformation of our military forces is critical to meeting the military challenges of the next century. Exploiting the revolution in military affairs is fundamental if U.S. forces are to retain their dominance in an uncertain world. Investment in research and development while closely monitoring trends in likely future threats are important elements of our transformation effort. A carefully planned and focused modernization program will maintain our technological superiority and replace Cold War-era equipment with new systems and platforms capable of supporting the full spectrum of military operations.[7]

It is clear that the United States military, and the Marine Corps specifically, must be ready to meet the needs of the nation across the full spectrum of conflict, and be able to provide the National Command Authority with a variety of options. These options stem from the variety of capabilities that the services bring to a particular conflict. These capabilities are constantly evolving as the world situation changes and technology advances. The military's vision for how it will meet the needs of the future is addressed in the Chairman of the Joint Chiefs of Staff's *Joint Vision 2020.*

Joint Vision 2020 addresses the operational concepts of Dominant Maneuver, Precision Engagement, Focused Logistics, and Full Dimensional Protection.[8] Dominant Maneuver is defined as,

> …the ability of joint forces to gain positional advantage with decisive speed and overwhelming operational tempo in the achievement of assigned military tasks. Widely dispersed joint air, land, sea, amphibious, special operations and space forces, **capable of scaling and massing force or forces and the effects of fires as required for either combat or noncombat operations**, will secure advantage across the range of military operations through the application of information, deception, engagement, mobility and counter-mobility capabilities.[9]

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[7] A National Security Strategy for a New Century, 21.
[8] Joint Vision 2020, 19.
[9] Ibid., 20.

It is key to note that portion of the definition that refers to the "scaling and massing of force and the effects of fires as required". This implies that there is more than one option in the use of fires and that there is a scalable nature to those fires. While not specifically addressing ground based fires, it is important to note that the Joint Chiefs felt that the concept of fires was important enough to include it in the definition of one of the basic concepts of full spectrum dominance. Clearly there is a requirement for the Marine Corps to field forces that are both flexible and can engage in combat across the full spectrum of conflict. The artillery is obviously only one of the fire support assets available to the maneuver commander on the present day battlefield, and the scope of this paper will be limited to Marine artillery specifically.

Roles and Missions of the Artillery

Marine Artillery is made up of 3 components which function together as a fire support system. The fire support system is composed of: 1) target acquisition, 2) weapons systems, and 3) command and control. Each of these components should be considered with respect to the other two when addressing a solution to a fire support system for a future Marine Corps. When addressing force structure and organization, it should be kept within the context of this system as a whole and not just one component. With that in mind, it is beyond the scope of this paper to address the entire artillery system in detail, but a brief discussion is necessary to understanding how the weapons systems fit into the entire piece. This paper will focus on the weapon systems portion of the overall fire support system.

The mission of U.S. Army Field Artillery is to destroy, neutralize or suppress the enemy by cannon, rocket and missile fire and to help integrate all fire support assets into

combined arms operations.[10] Because the Marine Corps does not possess all of the Field Artillery assets that the Army does, the mission of Marine artillery differs slightly. The mission of artillery in the Marine Corps is "…to furnish close and continuous fire support by neutralizing, destroying, or suppressing targets which threaten the success of the supported unit."[11]

In order to accomplish this mission, the artillery has three roles or tasks that it must accomplish: 1) Provide timely, close, accurate, and continuous fire support; 2) Provide depth to combat by attacking hostile reserves, restricting movement, providing long-range support for reconnaissance forces and disrupting enemy command and control systems and logistics installations (i.e., shaping the battlefield); and 3) Deliver counterfire within the range of the weapon systems to ensure freedom of action of the ground forces.[12] One can further clarify these three tasks by stating that they are:

1. Close Support Fires
2. Interdiction Fires
3. Counterfire

Whatever the combination of force structure and weapons systems the Marine artillery procures must be able to accomplish all three of these tasks to some degree or other. In order to be able to make a determination as to what the appropriate structure and equipment the artillery should have, we must first define what these tasks entail.

Close support fires are those fires that are used to engage enemy troops, weapons, or positions that are threatening or can threaten the force in either the attack or the defense. These fires allow the maneuver commander to rapidly multiply combat power effects and shift fires quickly about the battlefield. The purpose of close support fires is to expand

[10] FM 6-20, 9.
[11] MCWP 3-16.1, Para. 1002.

the depth of the battlefield, erode enemy forces, and inflict damage well beyond direct-fire ranges.[13]

Counterfires are those fires that are used to attack enemy indirect-fire systems, including mortars, artillery, air defense, missile, and rocket systems. The purpose of counterfires is to allow freedom of action to the supported maneuver forces.[14] The counterfire role is normally assigned to artillery units assigned a standard tactical mission other than direct support, or in the case of Marine artillery where there are no dedicated general support units, it may be assigned to any artillery unit. All of the current artillery battalions have a limited capability to conduct counterfire. One limiting factor for Marine artillery units is the range of the current weapons system. Many systems (both cannon and rocket systems) in use throughout the world have a greater range than the M198, and may therefore preclude the use of artillery in a counterfire role against those systems. The MAGTF currently solves this problem through the use of aviation assets to wage a counterfire battle, thus taking away limited aircraft from other missions that those aircraft could be conducting for the maneuver commander. This has generally worked for the Marine Corps in recent history. However, in a situation where the Marine Corps does not maintain the initiative or control the tempo of the battle, a 72 hour ATO cycle is hardly responsive enough to meet the needs of the infantry commander.

Interdiction fires are used to disrupt, delay and destroy enemy forces that, because of range limitations or intervening terrain, cannot fire their primary weapon systems on friendly forces. Normally, interdiction fires will be used against first-echelon forces not participating in the direct battle and follow-on echelons. These fires will add to the

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[12] Ibid., Para. 1003.
[13] FM 6-20, 10.

friction and chaos within enemy units to create “gaps” for the friendly maneuver units to exploit.[15]

As one looks to build capabilities into the MAGTF for the ground based fire support piece, the ability to accomplish the three roles discussed above must be resident in whatever artillery forces are decided upon. From those forces, the commander has the ability to weight the battle in whatever manner he chooses by organizing his artillery forces for combat. The process by which the commander organizes his artillery for combat is beyond the scope of this paper, but suffice it to say that once he does, he may assign any one of four standard tactical missions to his artillery units. Those tactical missions are shown in Figure 2, along with the seven inherent responsibilities associated with each mission.

[14] Ibid., 11.
[15] Ibid.

AN FA UNIT WITH A TACTICAL MISSION OF-	DIRECT SUPPORT	REINFORCING	GENERAL SUPPORT REINFORCING	GENERAL SUPPORT
Answers calls for fire in priority from-	1. Supported unit 2. Own observers[1] 3. Force FA HQ	1. Reinforced FA 2. Own observers[1] 3. Force FA HQ	1. Force FA HQ 2. Reinforced unit 3. Own observers[1]	1. Force FA HQ 2. Own observers[1]
Has as its zone of fire-	Zone of action of supported unit.	Zone of fire of reinforced FA.	Zone of action of supported unit to include zone of fire of reinforced FA unit.	Zone of action of supported unit.
Furnishes fire support personnel[2]-	Provides temporary replacements for causality losses as required.	No requirement.	No requirement.	No requirement.
Furnishes liaison to-	No requirement.	Reinforced FA unit HQ.	Reinforced FA unit HQ.	No requirement
Establishes communication with-	Company fire support officers (FSOs) and supported maneuver unit HQ.	Reinforced FA unit HQ.	Reinforced FA unit HQ.	No requirement.
Is positioned by-	DS FA unit commander or as ordered by force HQ.	Reinforced FA unit or as ordered by force FA HQ.	Force FA HQ or reinforced FA unit if approved by force FA HQ.	Force FA HQ.
Has its fires planned by-	Develops own fire plan.	Reinforced FA unit HQ.	Force FA HQ.	Force FA HQ.

[1] Includes all TA means not deployed with supported unit (radar, aerial observers, survey parties, and so on).

[2] An FSE for each maneuver brigade, battalion, or cavalry squadron and one FIST with each maneuver company or ground cavalry troop are trained and deployed by the FA unit authorized these assets. Marine Corps artillery battalions provide FO teams to each company-sized maneuver unit upon deployment. After deployment, FISTs and FSEs remain with the supported maneuver unit throughout the conflict.

Legend: DS = direct support, FA = field artillery, HQ = headquarters, TA = target acquisition

Figure 2.[16]

Of particular note is the responsibility to "Furnish Forward Observer and Replacements…". Note that only the direct support mission requires that these elements be provided to the supported maneuver unit. A battalion that had a habitual role as general support, for example, would not need the organic force structure of three forward observer teams and a liaison team, thus reducing the Table of Organization (T/O) strength of that battalion as compared with a direct support battalion. This responsibility to furnish liaison teams and observers will become relevant later in the paper.

Having discussed the roles and missions of the Marine artillery, one must then determine how those roles fit into the operational warfighting concepts of the future in order to determine what type force will be necessary to accommodate future operations.

Warfighting Concepts

Operational Maneuver From The Sea (OMFTS) requires that improvements in seven critical capabilities must occur in order for it to be a viable concept. These capabilities are: 1) Mobility, 2) Intelligence, 3) Command and Control, 4) Fires, 5) Aviation, 6) Mine Countermeasures and 7) Combat Service Support. When addressing the fires capability, it states that, "…we will increasingly take advantage of sea based fires and seek shore based fire support systems with improved tactical mobility…increased range and improved accuracy."[17] The maneuver forces envisioned in OMFTS will consist of combined arms teams with organic supply and maintenance capabilities that will be resupplied from the seabase as necessary.[18] This requires that whatever systems are supporting the combined arms teams must be made up of equipment that is both reliable and easily resupplied from either the surface or by air. Additional shipping space could be made available for landing force requirements from weapons that are smaller and more capable than those that exist today. The M198 howitzer weighs 16,000 pounds and takes up an enormous amount of space. It represents a massive footprint for a weapon of limited maneuverability and range. Reducing the weight of this howitzer will also reduce the size of the vehicle necessary to move it and again reduce space necessary for sealift, assault craft, and logistics requirements. All of these factors equate to a reduction in the time needed for a Ship To Objective Maneuver (STOM) force to accomplish its mission.

[16] FM 3-09, 2-31.

The Marine Corps will have to develop new ways of addressing the fire support issue as it relates to the concepts of OMFTS and STOM. *The United States Marine Corps' Warfighting Concepts for the 21st Century* states, "…landing forces armed with the C^2, tactical mobility, and fire support capabilities of the present will be hard pressed to decisively engage an enemy who is likely to combine the destructive capability of a conventional force with the elusiveness of a guerilla."[19]

The concept of operational maneuver from the sea will require an increase in the current capabilities of the Marine Corps in the areas of mobility, intelligence, command and control, fires, aviation, and combat service support. OMFTS specifically requires that we "seek shore-based fire support systems with improved tactical mobility".[20] The current M198 howitzer has a relatively poor rate of mobility and is slow to emplace and displace. In addition, it is difficult to get ashore during amphibious operations, and even more difficult to operate in arctic type operations. With a maximum rate of fire of only 4 rounds per minute, it is not very responsive to fire requests and requires a relatively large number of weapons to achieve a large effect on a target. The maximum cross-country speed for the M198 is 5 miles per hour. By comparison, the Light Weight 155 howitzer (M777) that is currently in development weighs only 9000 pounds, can be emplaced and displaced rapidly (approximately two minutes) and has a maximum rate of fire of 5-8 rounds per minute. Maximum cross-country speed for the M777 is 24 kilometers per hour (16 mph). This is clearly a step in the right direction for Marine artillery, but it does not answer the question of multiple systems to provide both a scalable force capable of

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[17] USMC warfighting concepts for the 21st Century, I-19.
[18] Ibid. II-16.
[19] Ibid. I-8
[20] Ibid. I-19

accomplishing a variety of tactical missions and provide a variety of capabilities that span the threat spectrum in order to counter whatever threat the Marine Corps might face in the future.

Essential Capabilities

On 10 January, 2000, the Commanding Generals of the 1st, 2nd, 3rd, and 4th Marine Divisions wrote a letter to the Commandant of the Marine Corps titled, "Ground Fire Support", that outlined a "road map" to fixing ground fires in the Marine Corps. Several essential capabilities are specifically mentioned, but the overarching consideration for fixing ground based fire support is,

> To achieve decisive victory, fire support must set the conditions for success – whether in major theater war or in smaller scale contingencies. Fire support organic to Marine forces is inadequate for today's battle and poorly postured to meet required OMFTS/STOM capabilities that must be in place by 2015.[21]

The paper acknowledges the fact that the Marine Corps will continue to fight with a combined arms focus, incorporating aviation and naval surface fire support, and that ground based fires should be viewed within the context of the complimentary capabilities provided by these assets.

Paragraph 4 of the letter is titled "Required capabilities", and it states,

> Our challenge both now and in the future is to provide responsive and continuous deep shaping fires, counterfire, and close supporting fires to forces maneuvering at ever-increasing speed and depth in conflicts that are becoming increasingly more difficult-to-define. To meet this challenge, our fire support system must collectively provide accurate and lethal fires, continuously available in all weather conditions; responsive through integrated C2 nodes; lethal across a spectrum from high volume shaping to precision destruction missions; mobile in range capability, speed of movement, and ammunition transport/handling; expeditionary in strategic movement, support, and sustainment; integrated with air, NSFS and intelligence systems; and flexible through a balance of complementary fire support assets that can be tailored to handle any mission along the spectrum of conflict.[22]

In order to meet these requirements, the letter proposes establishing an artillery Operational Advisory Group to,

> …provide a forum to address and resolve fire support related issues within the operating forces. It acts as an action body to provide input and recommendations to the annual Ground Board via the Quad-Division Conference with the ultimate aim of improving fire support for MAGTF operations.[23]

The Artillery Operational Advisory Group (Artillery OAG) Solution

The Artillery OAG was established in July of 2000 with the primary purpose of providing a forum for establishing community priorities and providing direct interaction between the operating forces, the advocate (DC, PP&O), requirements officers, program managers, resource sponsors, technical advisors, and other working level representatives involved with issues concerning the artillery community.[24] The OAG is divided into three groups or committees: the Executive Steering Committee, the technical consultation group and working groups.

The proposed solution to the Marine artillery problem is currently composed of improving (or even developing) the capabilities of effective target acquisition, a triad of weapon systems, integrated command and control, and ammunition in order to build a capability to meet the needs of both the present and the future Marine Corps. The elements of the field artillery system that the OAG addressed are; a Ground Weapons Locating Radar (GWLR) to replace the current AN/TPQ-46A, a laser rangefinder/ locator/designator to replace the AN/GVS-5, the development of UAVs to observe and control deep fires, a Tactically Integrated Command and Control (TIC2) system, the development of a Mortar Ballistic Computer (MBC) to integrate mortars into the current C4I architecture, and a Firing System Triad.[25] All of these items would be required to achieve the vision of fixing ground fires, yet while the OAG discusses fixing the field

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[21] Ground Fire Support paper dtd 10 Jan 00, 1.
[22] Ibid., 3.
[23] Ibid., 8.
[24] Memorandum from the Chairman, Marine Corps Ground Board., dtd 31 July 2000.
[25] Ground Fire Support Paper, 4-5.

artillery system as a whole, this paper will focus mainly on the Firing System Triad portion of the overall system.

The weapon system triad portion of the solution consists of three separate systems that provide the MAGTF commander with flexibility and the ability to tailor the force to meet any contingency across the spectrum of combat. The three systems are:

SYSTEM	ROLE/MISSION	ORGANIZATION
1. LW 155 (M777)	Direct Support system	4 active Battalions/Regiment
2. HIMARS	General Support system	2 reserve Battalions
3. VLE	Very Lightweight Expeditionary System	1 Battery / Artillery Regiment

The first part of the triad solution is the direct support piece and is a relatively easy solution from all perspectives. The M777, LW 155 will replace the current M198 howitzers on a one for one basis. This maintains the same organic direct support capability in the Marine division, without a loss or gain in manpower structure. The crew size of the new howitzer will remain the same as that of the M198. With the new system will come a slight increase in capabilities, notably mobility, speed of emplacement and displacement, and an increase in the maximum rate of fire. The range of the weapon and ammunition types available will remain unchanged.

The second portion of the triad will be the addition of the High Mobility Artillery Rocket System (HIMARS), which will be incorporated into the MEF as a general support weapon system. The current plan calls for two battalions of HIMARS to be placed in the reserves, replacing two reserve battalions of M198s. This provides a tremendous increase in capability for the MEF and will allow the commander to be able to influence the deep battle space with a ground based fire support asset that would be chopped to the MEF in time of war. By placing the HIMARS in the reserves, there are obviously no issues or

problems relating to active duty force structure increases, and HIMARS will be a joint program with the Army. Ammunition for the HIMARS system is compatible with the Multiple Launched Rocket System (MLRS) that is currently being used by the United States Army.

The final portion of the triad will be filled by what was initially called the Very Lightweight System (VLS), and what is currently being called the Expeditionary Fire Support System (EFSS). There are a number of different systems being discussed that could fill the role of an EFSS. The current Marine Corps position on the capabilities of an EFSS is that it should be able to:

1. Provide all weather, ground–based, close supporting, accurate, immediately responsive, and lethal indirect fires in support of the MAGTF.
2. Be capable of successfully engaging a spectrum of potential point and area targets, including motorized, light armored, and dismounted personnel targets, command and control systems, and indirect fire systems.
3. Be especially well suited for missions requiring speed, tactical agility, and vertical transportability.
4. Maintain a tactical mobility, both in the air and on the ground, equal to the supported force.
5. Be the principle indirect fire support system for the vertical assault element of a STOM force.[26]

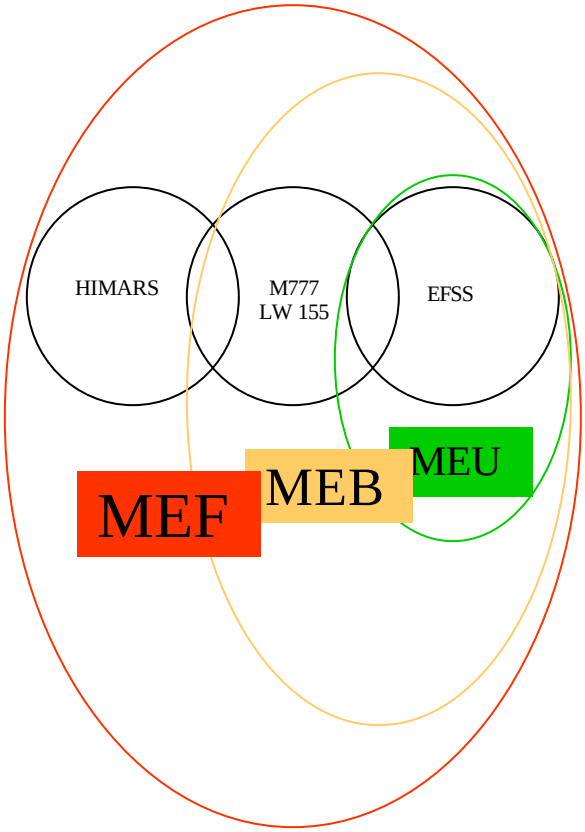
The table below shows the performance parameters currently assigned to whatever EFSS system the Marine Corps chooses to procure.

Performance Parameters	Performance Characteristics	
	Threshold	**Objective**
Range	8 Km	20 Km
Accuracy	<120m @ 75% max range	<30m @ 75% max range
Transportability	Internally transported by CH-53E	Internally transported by MV-22
Interoperability	AFATDS, TLDHS	
Crew	5	3
Max Rate of Fire	6 rounds per minute	10 rounds per minute
Sustained Rate of Fire	3 rounds per minute	5 rounds per minute
Emplacement Time	2 minutes	<1 minute
Displacement Time	2 minutes	<1 minute
Modular Convertibility (Convert from towed configuration to internal aircraft configuration)	<30 minutes	<5 minutes
Prime Mover	CH-53 internally transported vehicle	MV-22 internally transported vehicle
Ammunition	Illum, Smoke, WP, HE, DPICM	Improved fragmentation/blast unitary, infrared illumination
Automated/Onboard Navigation/Pointing System	Yes	Yes
Automated/Onboard Fire Control/Fire Direction	Yes	Yes

EFSS Performance Specifications[27]

[26] EFSS Position Paper 19 Oct 01.
[27] Ibid.

The Triad Concept



The above diagram illustrates the triad concept as proposed by the Artillery OAG. It shows how the different sized MAGTF's could conceivably deploy with multiple fire support capabilities, and those capabilities could be increased as the size of the MAGTF increases.

While this triad is clearly a viable solution, it may not represent the optimal solution to address the capabilities, responsiveness and flexibility that are required by the operational concepts previously discussed. Several issues make this solution to the artillery problem less than optimal.

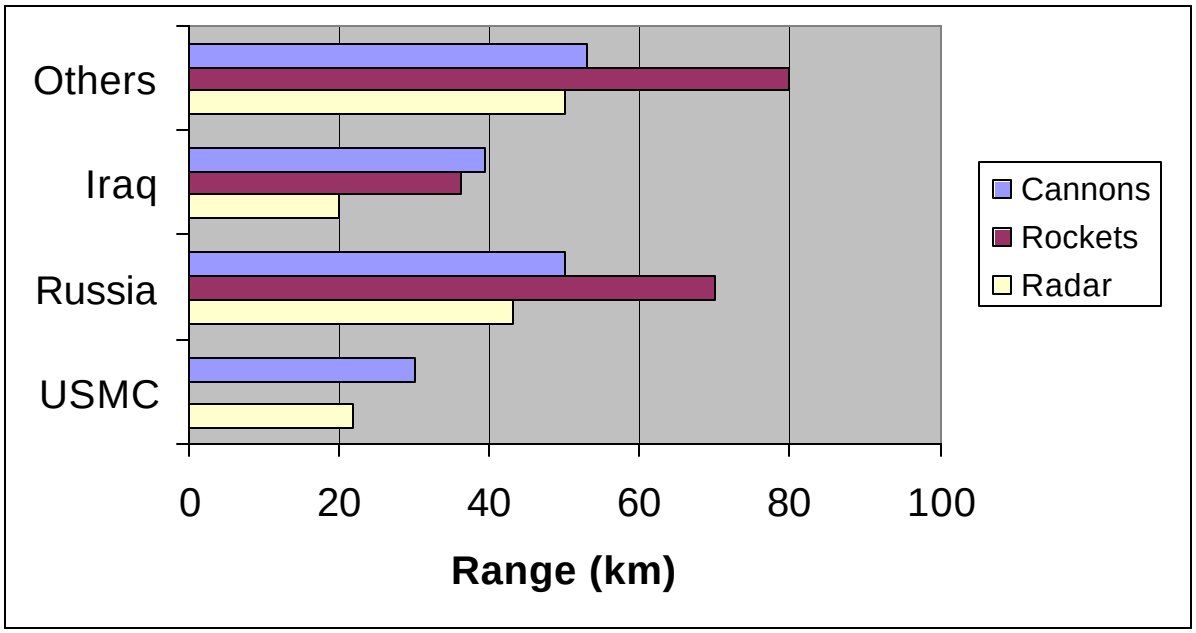
Having a HIMARS capability in the reserves does not effect active duty force structure. For the division commander as a part of a MEF sized MAGTF, having his general support artillery capability in the reserves poses little problem. One can reasonably assume that any threat scenario that requires the employment of the MEF will also require a total force solution, and not just an active duty one. As previously mentioned, general support artillery units do not maintain any habitual relationships with maneuver units, and do not provide forward observer and liaison teams to any specific maneuver units. If reserve HIMARS units were activated to augment a MEF, the only relationships that would need to exist would be between the division and that HIMARS unit, and adequate peacetime training could easily be conducted to accomplish the general support mission for that division.

For a smaller size MAGTF, this could potentially create a problem for the GCE commander in his ability to provide an adequate shaping or counterfire capability with his ground based fire support assets. While the MAGTF retains its fixed wing and rotary wing aircraft assets to shape the battlespace, those assets are both limited, and being used by the MAGTF commander (and not necessarily the GCE commander) to prosecute the deep fight. What this leaves the GCE commander with is his organic ground based fire support assets and whatever aviation assets the MAGTF commander has left over. General Jones, 32nd Commandant of the Marine Corps recently stated, "Eventually, we may want HIMARS in the active force as well—say a HIMARS battery per division. But, initially, the system will go into the 14th Marines, giving us the added capability during a major theater war."[28] The key part of that statement is "…during a major

[28] Field Artillery Journal, Sep-Oct 2000, 3.

theater war", which implies that the system would not be available for operations that do not constitute a major theater war.

What capabilities for shaping/interdiction and counterfire operations are at the disposal of the MAGTF commander in a MEB or MEU sized operation? Without the total force solution, the answer must lie with aviation assets. Given the limited number of artillery battalions available to support the infantry regiment and its associated battalions, a tank battalion, an LAR battalion and the MAGTF commander, the current Marine artillery organization is insufficient to meet the needs of all these commitments. One could argue that the current structure provides that capability to conduct close support fires in a direct support mission and little else.



Source: "Fix Fires - Status Brief to the PRG - Oct 00" - Major K.A. Hawley

Many other countries that we are likely to face in the future maintain the ability to outgun and outrange the Marine artillery. The counterfire threat will be, for the foreseeable future, of serious concern to maneuver forces and will more than likely be the

most dangerous threat to the GCE. If the MEB commander uses his fixed wing aviation assets to fight a counterfire battle, who then conducts deep interdiction and shaping operations in support of the GCE? Without a general support artillery capability within the MEB, there will always be a compromise and not a solution to this problem. The MEB sized MAGTF faces serious allocation issues in terms of fire support, but the issue at the MEU level takes on an even different shape.

The current M198 howitzer is too large and too heavy to fight and be relevant in MEU operations. Its relative mobility with respect to the other assets within the MEU coupled with its large size and weight provides a difficult challenge for a MEU sized element to deploy it. At 16,000 pounds (for the gun alone, without the prime mover), the M198 can only get from ship to shore in either an LCAC or LCU.[29] Once ashore, the weapon has limited mobility (5 mph cross country speed) because of its weight and the lack of a suspension system, and its mobility is further limited to the capabilities of the prime mover. Improved surface road networks are required to transport the weapon around the battlefield and may not exist in many parts of the world.

The M777 LW 155 howitzer should solve most of the mobility problems associated with the M198, but there still exists a problem connected with all 39 caliber, 155mm systems… range and ammunition supply. The logistics support for a 155mm weapons system is relatively extensive because of the size and weight of the ammunition. While a 155mm projectile provides a good deal of firepower, it comes at a price. The price is paid by the lift capability and limited number of our current logistics assets that are

[29] Transport by CH-53E is also an option, but the weapon has no mobility without its prime mover. Once emplaced, it would have to be eventually married up with its prime mover or extracted by CH 53E assets. This leaves the system in a very vulnerable position to either ground attack or counterfire.

capable of providing ship to objective ammunition resupply of forces engaging in operational maneuver from the sea.

Before illustrating the ammunition supply/resupply capability of the MEU, one should consider that a basic allowance (BA) for a battery is 677 projectiles.[30] A pallet of 155mm ammunition (8 rounds) weighs approximately 800 pounds. Because 155mm ammunition is separate loading,[31] a pallet of projectiles is only part of the solution. The other components of a complete round only compound the problem and create an additional logistics challenge for the MEU. As an example, to transport 480 rounds of ammunition (only 2/3 of a BA) from ship to objective using CH-53E aircraft (primary aviation logistics platform for the MAGTF) would require 3 sorties. For CH-46 aircraft it would require 20 sorties, and using the V-22 aircraft it would require 8 sorties just to supply the projectiles that would provide 80 rounds per gun in a six gun battery. Assuming that each fire mission that the battery engaged in used only six rounds per gun (Battery six), and the battery only fired six missions every hour, that ammunition would last the battery 2 hours and 10 minutes.

If the battery were located 100 miles from the ships, and using the number of sorties calculated above, it would take three of the four CH-53E helicopters that the MEU owns 1 hour and 30 minutes to complete the resupply of projectiles only. One would also have to then figure out a way to supply the battery with propellant, fuzes and primers. From this example, the only heavy lift aviation asset that the MEU has would be tied up supplying the battery with ammunition for virtually the entire battle.

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[30] MCWP 3-16.1 appendix K-7.

[31] Separate loading means that the projectile, propellant, fuze, and primer that make up a complete round of ammunition are received and loaded into the weapon separately. From a logistics perspective, when

	AIRCRAFT TYPE		
	CH-46	MV-22	CH-53E
Aircraft weight	16000	33000	36500
Crew	1000	1000	1000
Fuel	4800	9000	15000
Total	21800	43000	52500
Max Takeoff weight	24300	50000	73000
Lift	2500	7000	20500
# of 155mm Pallets/lift	3	8	25
# Sorties/60 Pallets	20	8	3
Time to Resupply Battery with 4 Aircraft			
200 mile round trip	200	200	200
Speed of A/C	120	220	150
Time to travel 200 mi.	100	55	80
Hookup time	5	5	5
Dropoff time	5	5	5
Refuel time on deck	20	0	0
Total time (in minutes per aircraft)	130	65	90
# of 4 A/C flights needed	5	2	1
TOTAL AMOUNT OF TIME NEEDED (minutes)	650	130	90
TOTAL AMOUNT OF TIME NEEDED (hours)	10 hrs 50 min	2 hrs 10 min	1hr 30 min

As a light, mobile, expeditionary force, the MEU should be able to deploy with a system or systems that are easier to logistically support than a 155mm weapon system that can only provide a 20 km range.

resupplying 155mm artillery ammunition one must plan to supply each piece of the complete round so that the number of each component matches the number of projectiles resupplied.

Only supplying the MEU with one ground based fire support asset like the EFSS is probably not the answer either. The MEU commander should have a mix of assets that he can task organize to meet the challenges of any contingency that arises.

Ammunition is Part of the Solution

While no solution will be agreed upon by everyone, there are clearly other options to fixing Marine artillery. As previously mentioned, a part of the solution to fixing the artillery must lie in ammunition changes and not just a weapon system change from a 16,000 pound howitzer to a 9,000 pound one. By improving the accuracy and lethality of 155mm munitions, the logistics burden could be substantially reduced. In a recent Field Artillery Journal article about Sense And Destroy Armor (SADARM)[32], a test was conducted to determine how much the increased lethality of a precision munition effected logistics. The test was conducted on the Target Acquisition and Fire Support Model (TAFSM) and certified by the Army's Training and Doctrine Command Requirements and Analysis Center (TRAC). The test determined,

> …SADARM's increased lethality decreased the ammunition logistical burden for our light forces by 30 percent over DPICM.[33] When deploying a light artillery force package (including three battalions of 155mm M198 howitzers), the Army can save 53 sorties by deploying SADARM vice DPICM. The artillery force package using SADARM retains the equivalent firepower effectiveness but requires one less M198 battalion (saving 36 sorties) and fewer follow-on sorties for ammunition resupply (saving 17 sorties).[34]

This type of logistical savings is typical of what any precision munition could provide and makes it worth investing more money into guided or precision type 155mm

[32] SADARM is a 155mm projectile that contains two submunitions which are expelled from the round over the target area. Each submunition contains both infrared and millimeter wave sensor systems to acquire the target. Once a target is detected, the submunition fires a shaped charge penetrator that will defeat all known armor systems.
[33] Dual Purpose Improved Conventional Munitions.
[34] Field Artillery Journal, July-August 2000, 39.

ammunition. The ability to improve both the accuracy and the range of 155mm ammunition has been demonstrated by programs like the XM982 Excalibur. The XM982 is a family of 155mm precision guided, extended range projectiles that will provide a 40,000-meter range when fired from the current M777 howitzer. Each projectile could carry DPICM, SADARM or Unitary warhead submunitions, while maintaining a constant CEP[35] of approximately 17m regardless of range. When compared to conventional unguided munitions such as the M864 Base Bleed DPICM projectile which has a CEP of 278 meters at maximum range, one can quickly see how new ammunition can dramatically improve performance and reduce logistical requirements from the same howitzer.[36] Changes in ammunition will allow increases in capability regardless of which weapon systems are chosen to support the Marine Corps.

Assumptions

The author made several assumptions when determining the proposed structure and organizational changes to the artillery regiment. Those assumptions are:

1. No changes can be made to increase active duty force structure numbers above current congressionally mandated end strength numbers.
2. Money can be made available for the additional procurement of HIMARS launchers and the associated supporting establishment related with 36 HIMARS systems.
3. The independent (Tank and LAR) battalions would require a standing Liaison section. Forward observers would be provided by their organic personnel cross-trained in call for fire techniques. Tanks and LAR already have an 0802 assigned as their FSC for fire planning purposes and fire support coordination, and so no additional 0802 officers would be needed to fill the FSC position.

[35] Circular Error Probable.
[36] Raytheon and Excalibur Program, Power Point presentation.

4. A mortar is an infantry weapon regardless of size. "The mission of mortars is to provide immediate and close supporting fires to the maneuver forces in contact."[37] If the infantry regiments want to give up 81mm mortar tubes and substitute them for 120mm mortars, it would be up to the infantry community to decide this.
5. Any system procured will be a joint program.

If the artillery is going to produce what it advertises, it must be capable of performing all three roles of Marine artillery. It must be composed of systems capable of providing close support fires, interdiction and counterfire. It must provide the maneuver commander with flexibility and be able to be task organized for any size contingency. It should provide a capability to fill the gap in fire support from ship to shore during amphibious operations when conducting OMFTS. Finally, it must take advantage of viable, proven, emerging technology so as to provide a long-term solution to fixing the artillery.

Conclusion

I propose adopting the triad approach presented by the artillery OAG, with modifications. The Marine Corps should keep the direct support capability provided by the M198 so that each infantry regiment has a habitually associated artillery battalion that could support it. Those artillery battalions do not actually belong to the infantry regiments, nor are there any formally established command relationships with them. All of the artillery assets within a division belong to the division commander, and may be organized in any manner the division commander deems necessary. But habitual relationships facilitate the innate decision making ability between the members of the

[37] FM 6-20, 13.

staffs that are required in an expeditionary maneuver warfare concept. This would provide each infantry regiment with the capability to have, if so organized for combat, a direct support artillery battalion. Even when the Marine divisions had five active battalions of artillery, two of those battalions were formally designated as general support battalions anyway, and so there would be no reduction in capability from a direct support perspective.

In order to improve the amphibious transportability, mobility, survivability, and range of close support artillery, I propose that the Marine Corps replace the current M198 howitzer with a truck mounted 155mm howitzer similar to the French "Caesar" system. Three of the four active duty battalions of the artillery regiments would be changed to this type of system, and would act as the primary direct support/close support for the MAGTF. The French built Caesar is a 52 caliber, 155mm cannon mounted on a 6-ton truck chassis. The advantages of this system over the current M198 or the proposed M777 are considerable in any wartime scenario or environment.

In terms of square-footage, four Caesars will fit into an LCAC as compared with only two M198 or M777 systems. It is transportable by C-130 aircraft. It is capable of highway speeds on hard surface roads and is more than twice as fast as a towed system on unimproved surfaces. The Caesar can emplace, fire six rounds and displace, all in less than 6 minutes. The Caesar's 52 caliber cannon allows it to achieve a range of over 40,000 meters with conventional ammunition, and it can store 18 complete rounds right on board the vehicle. The 52 caliber cannon allows for future range increases as 155mm ammunition technology improves, which would not be possible with the 39 caliber cannon on the M198 or M777. The crew for the Caesar system is only 5 Marines, and

therefore would provide a savings of approximately 270 cannoneer structure spaces per artillery regiment.

I propose that we replace the fourth active duty artillery battalion with a battalion of HIMARS in each artillery regiment. This will provide the division with a general support capability that is organic to the division. I propose that the organization of the HIMARS battalion be a 2 X 9 structure, that is to say that the battalion would consist of two batteries of nine launchers each. Reducing the number of battery command elements from three to two would save eight 0802 officer force structure spaces within each division. Designating the HIMARS battalion as a general support battalion would save another eight 0802 billets because there is no requirement for forward observer billets in a general support battalion. Additionally, each HIMARS launcher would have a smaller crew than the LW 155, thereby reducing enlisted force structure as well. Crew size of Marine HIMARS is currently undetermined, but if the crew size was reduced from the current 10 cannoneers on the M198 to 5 cannoneers per HIMARS, that would equate to a savings of 90 enlisted Marines.

The third element of the triad, EFSS, would take on two forms. One part of the EFSS solution would be to procure a heavy mortar system similar to the 120mm mortar that is currently being examined. The other part would be to procure a small, lightweight, highly mobile 105mm cannon system that is capable of firing long range, low cost, highly lethal munitions. The function of each system will be discussed.

If one 155mm battalion were taken from the current structure to acquire HIMARS, the independent Tank and LAR battalions would need additional close support assets that could support them. Some would argue that towed cannon artillery could, in fact,

adequately support a tank pure unit in any scenario. Having been the FSC for the 7th Marine regiment during numerous regimental (MEB type) exercises like Steel Knight, it is difficult at best to provide adequate cannon artillery support to armor. The vast difference in relative mobility between the M1A1 and a towed howitzer system with only a 20 km range[38] causes the artillery to displace too often trying to keep up. As everyone knows, current technology does not allow howitzers to fire while on the move, and the tanks are left without ground based fire support. In most cases during these MEB type live fire exercises, the tank units were allocated the preponderance of the available attack helicopters as their fire support.

The LAR battalion was also a difficult unit to support in a MEB type scenario. As a highly mobile deep reconnaissance asset, they are capable of operating well beyond the range of our current cannon artillery. The addition of HIMARS in the division would be a part of the solution to supporting these units, but I propose that the LAR battalion has another option. Take the 81 mm mortars that the LAR battalion currently has and convert these systems to 120mm mortars. LAR currently has eight LAV 81mm mortar variants organic to the battalion. Switching these to 120mm mortars would give the LAR an organic fire support asset capable of reaching 13 km. This system could also be used on the MEUs as either a replacement for the 105mm system, or to augment them and provide additional flexibility when task organizing the MEU. The 155mm ammunition resupply problem for the MEU would go away, and the MEU would have a highly mobile asset to provide a credible fire support capability for low intensity conflict scenarios.

[38] The normal M107 HE projectile has a max range of 18,100 meters. The advertised maximum range of 30,000 meters for the M198 is obtained using Rocket Assisted Projectiles (RAP), which only account for

The second part of the EFSS piece of the triad should have capabilities that take full advantage of the expeditionary nature of the concepts of EMW, OMFTS and STOM. A "fire on the move" capability to support ship to shore amphibious operations should exist, but current technology makes this little more than a dream. The ability to provide a viable expeditionary indirect fire support asset for the vertical assault element of a STOM force should be achievable for both the weapon and the prime mover. The prime mover for the system would be the HMMWV and not a 7-ton truck, and would therefore be readily air transportable with the gun. It should fire precision/guided munitions so as to reduce the logistical burden to the MAGTF (specifically the MEU's), and have a range capable of supporting an amphibious as well as a vertical assault force. It should be able to accomplish the three roles that the artillery must accomplish, i.e., close support, interdiction and counterfire. The crew of the system should be relatively small, so as to economize force structure. Based on these stated requirements, the system would more than likely have to be some type of expeditionary rocket system or (most probably) a modern cannon system like the newly developed 105mm South African G-7. The G-7 is currently capable of firing a projectile 30,000 meters, and the 105mm projectiles for that howitzer are four times more lethal than our current M107 155mm HE projectile.[39]

The 105mm cannon system should be organic to the Artillery regiment. The force structure to man this unit will come from the force structure savings generated by replacing each weapon system in the current cannon battalions with systems that require a crew size of 5 vice 10 cannoneers. I propose that the Marine Corps establish a fifth battalion of 105mm G-7s in each artillery regiment. The battalion would be composed of

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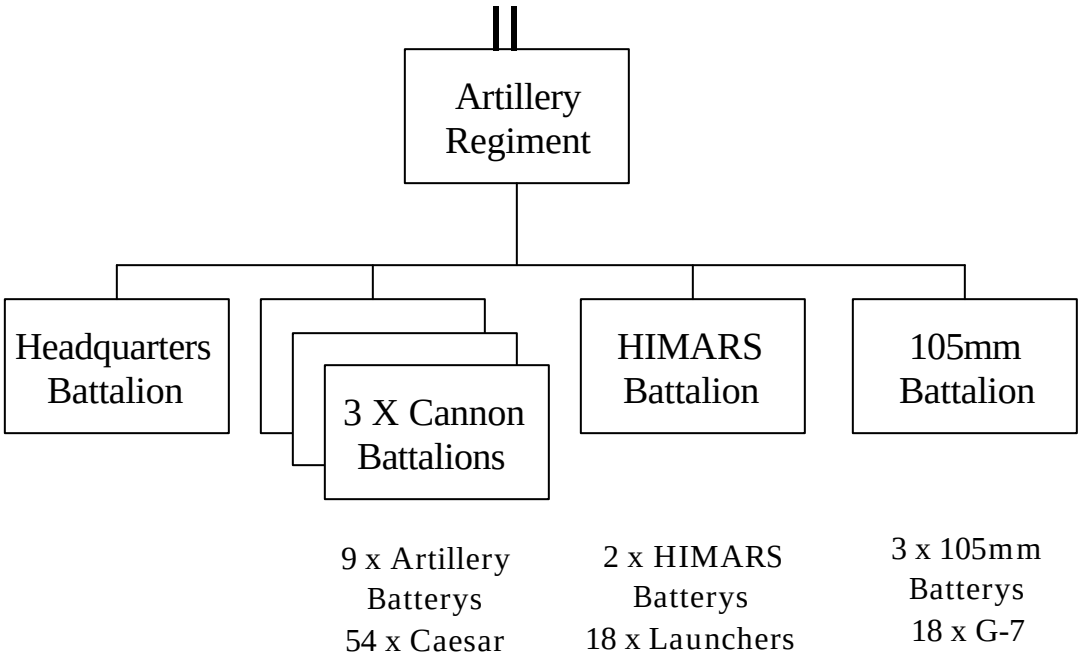
about 5% of the Basic Load for a battalion.

[39] Power Point presentation given by Mr. Mike Holthus, NGIC. 27 Feb 2002.

three batteries, and each battery would consist of six gun sections each. Each section would have a Table of Organization (T/O) strength of 5 Marines who would man whatever 105mm system the Marines employ.

The organizational diagram for the artillery regiment would be as follows:



All of the capability and equipment shown above would be organic to the division and could be obtained without an increase in the T/O structure of the artillery regiment. The regiment would have the capability to conduct close supporting fires with its three 155mm Caesar cannon battalions, who could potentially be reinforced by the HIMARS battalion or the 105mm G-7 battalion. Interdiction could be accomplished by the 155mm battalions, the HIMARS battalion or the 105mm battalions, or a combination of all three. Counterfire could be provided by any of the three, but primarily would be the responsibility of whatever units were designated as general support. The division

commander, advised by his artillery regimental commander, could organize for combat in whatever manner the tactical situation dictated.

Each MEU that the artillery regiment supports could have a 105mm battery of G-7s assigned to it, or it could take a battery of 155mm Caesars, or it could deploy with any number of HIMARS, or a combination of all three. The small size of each of these systems, when compared to the M198 or M777 with associated prime mover, allows the MAGTF commander to scale the amount of artillery support to match the threat condition he envisions.

By adopting a modified version of the triad concept of the Artillery OAG, and with some change to the organization of the artillery regiments, the Marine Artillery could once again have the capabilities and equipment to adequately support the Marine Corps of both the present and the future when employing the concepts of Expeditionary Maneuver Warfare, Ship to Objective Maneuver, and Operational Maneuver From the Sea.

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